

CS570 Spring 2022: Analysis of Algorithms Exam I

	Points		Points
Problem 1	20	Problem 5	18
Problem 2	9	Problem 6	16
Problem 3	6	Problem 7	13
Problem 4	8	Problem 8	10
	Total	100	

Instructions:

1. This is a 2-hr exam. Open book and notes. No electronic devices or internet access.
2. If a description to an algorithm or a proof is required, please limit your description or proof to within 150 words, preferably not exceeding the space allotted for that question.
3. No space other than the pages in the exam booklet will be scanned for grading.
4. If you require an additional page for a question, you can use the extra page provided within this booklet. However please indicate clearly that you are continuing the solution on the additional page.
5. Do not detach any sheets from the booklet. Detached sheets will not be scanned.
6. If using a pencil to write the answers, make sure you apply enough pressure, so your answers are readable in the scanned copy of your exam.
7. Do not write your answers in cursive scripts.
8. This exam is printed double sided. Check and use the back of each page.

1. 20 pts

Mark the following statements as **TRUE** or **FALSE** by circling the correct answer. No need to provide any justification.

i) [**TRUE/FALSE**]

If we add 1 unit to the cost of the two lowest cost edges in the graph G , then the cost of the MST of G will increase by 2 units

e.g. the first 3 lowest cost edges could have the same cost

ii) [**TRUE/FALSE**]

Every weighted undirected graph has at least one MST

(If the graph is not connected, there is no MST)

iii) [**TRUE/FALSE**]

We say that an algorithm runs in $O(1)$ if it takes it constant time to run when the problem size $n=1$

iv) [**TRUE/FALSE**]

A binary tree with k levels has 2^k-1 nodes.

v) [**TRUE/FALSE**]

The worst-case time complexity of merge sort is $O(n^2)$

vi) [**TRUE/FALSE**]

The worst case runtime of binary search satisfies the recurrence relation $T(n) = 2T(n/2)+c$ where c is a constant

vii) [**TRUE/FALSE**]

If a directed acyclic graph with 4 nodes has a unique topological ordering $(ABCD)$, then it must have at least 3 edges.

viii) [**TRUE/FALSE**]

Prim's algorithm cannot handle negative cost edges

ix) [**TRUE/FALSE**]

A binary max heap can be converted into a min heap by reversing the order of the elements in the heap array.

x) [**TRUE/FALSE**]

For $n > 3$, a directed graph with n nodes and n edges can be strongly connected.